

DRAFT

2016 Transportation Development Excise Tax Study

Prepared for:
City of Boulder, Colorado

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EXECUTIVE SUMMARY

As part of the 2016 work scope for the City of Boulder, TischlerBise will prepare three products to address the funding of transportation facilities and services. The first product is a Transportation Development Impact Fee (DIF) study that satisfies requirements of Colorado's impact fee enabling legislation. Given the impact fee requirement to quantify the reasonable impacts caused by, and directly related to, proposed development, the DIF study has a reduced growth cost that is less than the broader set of growth-related improvements used in the Development Excise Tax (DET) study. A future work product will focus on operational costs and on-going maintenance of Boulder's multimodal transportation system.

Boulder's DET is a one-time revenue imposed on new construction. An excise tax is imposed on the performance of an act, the engaging in an occupation, or the enjoyment of a privilege. In some states, home-rule cities may impose excise taxes using general taxation powers. Other states have limited the use of excise taxes to jurisdictions that have special enabling legislation. Boulder has collected an excise tax for transportation since the 1980s. In 1998, voters approved a consolidated DET that included transportation. By policy, a portion of the consolidated DET authorized by voters is also used to acquire land for parks, but the combined total for parkland and transportation is less than the total DET authorized for residential development. As part of the current work scope to update Boulder's DIF study, additional parkland needed to accommodate new development could be added to the Parks & Recreation DIF, which would provide significant additional DET funding capacity for transportation.

CURRENT TRANSPORTATION DET

As shown in Figure 1, the current Transportation DET is \$2.48 per square foot of nonresidential floor area and approximately \$2,227 per detached dwelling and \$1,650 per attached dwelling. Applying these rates to the projected increase in development within Boulder over the next ten years (see Land Use Assumptions by TischlerBise) would yield approximately \$11.5 million in Transportation DET revenue, with residential units contributing 43% of the six-year total and 57% from nonresidential development.

Figure 1: Transportation DET Rates Currently Collected

Tax Name	Nonresidential	Residential	
	<i>Per Square Foot</i>	<i>Per Detached Dwelling Unit</i>	<i>Per Attached Dwelling Unit or Mobile Home</i>
Development Excise Tax			
Park Land	N/A	\$1,144.84	\$795.98
Transportation	\$2.48	\$2,226.93	\$1,650.29
Total	\$2.48	\$3,371.77	\$2,446.27
Housing Excise Tax	\$0.51	\$0.23 per square foot	\$0.23 per square foot

The right column in Figure 2 indicates the maximum consolidated DET amounts approved by voters in 1998. Nonresidential development is currently paying the maximum rate, but residential development could pay up to \$5,630 per detached dwelling and \$3,624 per attached dwelling. One option to consider during the 2016 DET update is to increase the transportation DET rates up to the maximum for residential units, as approved by voters. This change would increase the DET by \$3,403 per detached dwelling and \$1,974 per attached dwelling. Based on the Land Use Assumptions, collecting the maximum DET from residential development would provide an additional \$6.4 million for transportation improvements over the next ten years (i.e. a total of \$17.9 million).

Figure 2: Maximum Voter-Approved DET Rates

TYPE OF DEVELOPMENT	CURRENT	PROPOSED 1999	PROPOSED MAXIMUM (LIMITED BY CPD)
NEW AND ANNEXING DETACHED DWELLING UNIT	3,667.05	4,331.06	5,630.38
NEW AND ANNEXING ATTACHED DWELLING UNIT	2,369.03	2,787.77	3,624.10
NEW, ANNEXING AND EXPANDED NON- RESIDENTIAL DEVELOPMENT	1.45 PER SQUARE FOOT	1.91 PER SQUARE FOOT	2.48 PER SQUARE FOOT

CONCLUSIONS

After evaluating the 1996 DET study, that emphasized moving vehicles and allocated costs accordingly, TischlerBise concluded the current Transportation DET rate schedule is not proportionate by type of development. Preliminary DET rates (see Figure 4) are expected to yield almost \$32 million over the next ten years, which will cover the growth share of planned transportation improvements (i.e. CIP plus Action Investment Program). In comparison, the current Transportation DET rate schedule would yield approximately \$11.5 million over the next ten years. Also, the current Transportation DET rate schedule would obtain approximately 43% of future revenue from residential development and 57% from nonresidential development. In contrast, the proposed 2016 DET methodology expects to obtain approximately 52% of future Transportation DET revenue from residential development and 48% from nonresidential development. TischlerBise also finds the current Transportation DET rate schedule to be inconsistent with best practices to ensure development charges are proportionate to the need for capital facilities. For residential development, TischlerBise recommends switching from the current Transportation DET approach, based on two housing types, to a DET schedule based on dwelling size (measured by square feet of finished living space). To be proportionate, the transportation DET rate schedule should also differentiate by type of nonresidential development as shown in Figure 4. For ease of administration and comparison, the transportation DET rate schedule is consistent with Boulder's 2016 DIF study for all other types of infrastructure.

PRELIMINARY 2016 TRANSPORTATION DEVELOPMENT EXCISE TAX

Figure 3 summarizes the methods and cost components used in Boulder’s 2016 Transportation DET study. Both the DIF and DET studies share the same types of capital improvements and cost allocation methods. The major difference between the two studies is the magnitude of cost, with the DET based on a more extensive set of growth-related transportation improvements (i.e. CIP plus Action Investment Program).

Figure 3: Proposed Transportation DET Methods and Cost Components

<i>Type of Improvements</i>	<i>Cost Allocation</i>	<i>Service Area</i>	<i>Plan-Based Method (future)</i>
<i>Walk / Bike / Transit</i>	Functional Population and Jobs	Citywide	Sidewalks, Multi-Use Paths, Bike Lanes and Bus Stops/Pullouts
<i>Streets</i>	Vehicle Miles of Travel	Citywide	Arterial/Collector Capacity and Intersection Improvements

Figure 4 shows the preliminary 2016 Transportation DET schedule, along with current Transportation DET rates. All but two nonresidential categories exceed the maximum DET rate, thus requiring voter-approval prior to implementation. For nonresidential development, DET rates are stated per square foot of floor area, except for “Nursing Home / Assisted Living” (per bed) and “Lodging” (per room). The preliminary DET schedule for nonresidential development is designed to provide a reasonable DET rate for general types of development. For unique developments, the City may allow or require an independent assessment.

For residential development, updated amounts are based on square feet of finished living space. Garages, porches and patios are excluded from the DET assessment. All but the smallest residential size range exceeds the maximum DET rate, thus requiring voter-approval prior to implementation.

The preliminary total DET is a combination of two cost components and different cost allocation methods. The cost of “Bus Bike Walk” capital improvements was allocated to the increase in population and jobs within Boulder. The cost of street improvements was allocated to the projected increase in vehicle miles of travel. Details regarding both cost allocation methods are provided in the middle section of this report.

Figure 4: Preliminary 2016 Transportation DET Schedule

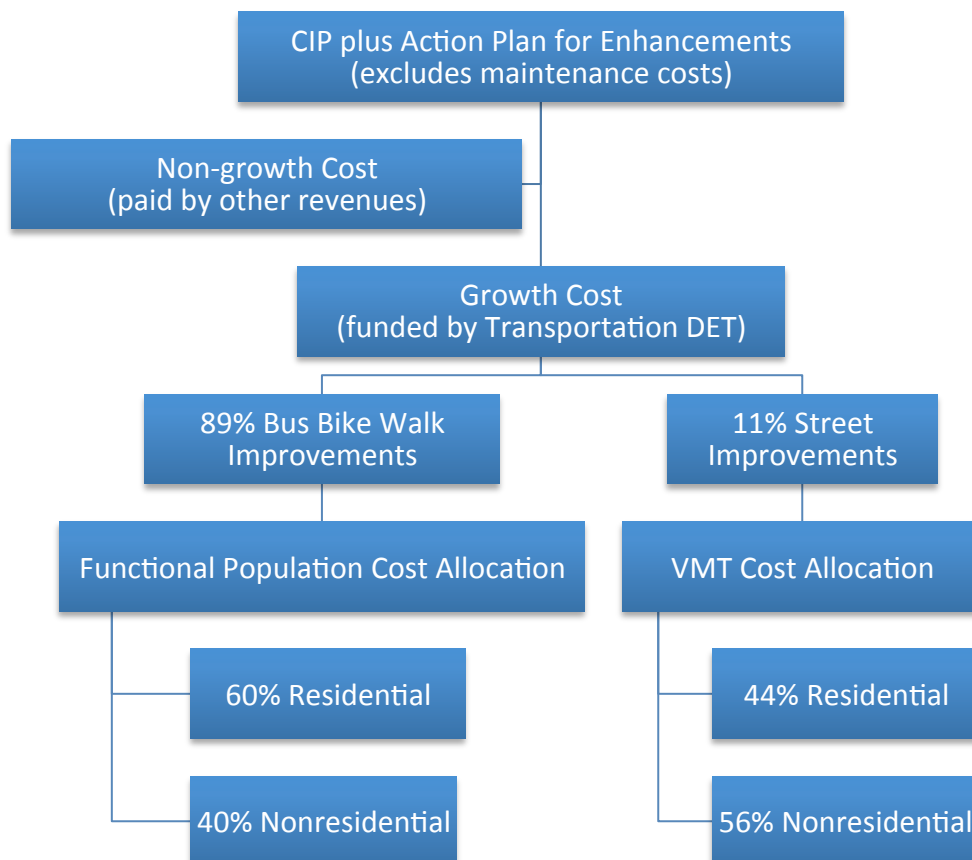
2016 Transportation DET	<i>Development Unit</i>	<i>Bus Bike Walk</i>	<i>Streets</i>	<i>Preliminary Transportation DET *</i>	<i>Current Transportation DET</i>	<i>Increase/ Decrease</i>	<i>Percent Change</i>
Residential (by square feet of finished living space)							
800 or less	Dwelling Unit	\$2,786	\$308	\$3,094	\$1,650	\$1,444	88%
801 to 1200	Dwelling Unit	\$4,286	\$486	\$4,772	\$1,650	\$3,122	189%
1201 to 1600	Dwelling Unit	\$5,214	\$597	\$5,811	\$1,939	\$3,873	200%
1601 to 2200	Dwelling Unit	\$6,000	\$691	\$6,691	\$2,227	\$4,464	200%
2201 or more	Dwelling Unit	\$6,738	\$780	\$7,518	\$2,227	\$5,291	238%
Nonresidential							
Retail / Restaurant	Square Foot	\$4.31	\$1.71	\$6.02	\$2.48	\$3.54	143%
Office	Square Foot	\$6.16	\$0.71	\$6.87	\$2.48	\$4.39	177%
Light Industrial	Square Foot	\$3.96	\$0.45	\$4.41	\$2.48	\$1.93	78%
Warehousing	Square Foot	\$1.58	\$0.23	\$1.81	\$2.48	-\$0.67	-27%
Institutional	Square Foot	\$1.39	\$0.60	\$1.99	\$2.48	-\$0.49	-20%
Hospital	Square Foot	\$5.05	\$0.85	\$5.90	\$2.48	\$3.42	138%
Nursing Home / Assisted Living	Bed	\$1,441	\$176	\$1,617			
Lodging	Room	\$978	\$525	\$1,503			

* Rates in red exceed voter-approved maximums.

MULTIMODAL TRANSPORTATION DET

The 2016 Transportation DET study uses a plan-based methodology that includes improvements for all modes of travel. Figure T1 provides an overview of the methodology. This study documents the general cost allocation between residential and nonresidential development, including detailed calculations used to derive specific DET amounts by dwelling size and type of nonresidential development. From the universe of all projects in Boulder's Capital Improvement Plan (CIP) and the Action Investment Program of the 2014 Transportation Master Plan (TMP), staff and consultants identified transportation improvements needed to accommodate new development over ten years. This study refers to these projects as "enhancements" to differentiate them from "maintenance" projects that are not eligible for DET funding. Also, each project was evaluated to quantify the "growth costs" to be funded by DET revenue, with non-growth costs funded by other revenues. Staff determined that 89% of enhancement projects are for Bus Bike Walk facilities (primarily moving people), with the remaining 11% for street improvements (i.e. primarily moving vehicles). The growth cost of Bus Bike Walk improvements was allocated to residential and non-residential development based on functional population (described further below). The growth cost of street improvements was allocated according to estimated Vehicle Miles of Travel (VMT) for general types of development.

Figure T1: DET Calculation Flow Chart



GROWTH SHARE OF FUTURE TRANSPORTATION ENHANCEMENTS

The 9.9% default growth share is based on the projected average annual increase in person trips to and from Boulder from 2010 to 2035 (illustrated by Figure 3-22 in Boulder's State of the System Report). Because internal-external travel is most evident during morning and afternoon peak hours, it is a key factor in our perception of traffic congestion. Figure T2 provides a reasonable means of quantifying the impact of growth on transportation facilities.

Figure T2: Person Trips To and From Boulder

Communities	2010	2035	Change	%Change
Broomfield	28,130	39,254	11,124	39.5%
Denver	13,643	14,416	773	5.7%
DIA	2,962	4,139	1,176	39.7%
ERIE	11,993	24,546	12,554	104.7%
Lafayette	18,613	21,564	2,950	15.9%
Longmont	40,976	47,774	6,798	16.6%
Lyons	1,892	1,968	77	4.0%
Louisville	25,799	26,214	415	1.6%
Superior	9,988	12,073	2,085	20.9%
TOTAL	153,995	191,947		

0.99% <= Average Annual Growth Rate

9.9% <= Percent Increase Over Ten Years

Data source

H:\Projects - Open\A-E\BOULDER Transit Master Plan 2012.777\05 Background\Travel Demand Model\Person_Trips

CIP PLUS ACTION INVESTMENT PROGRAM FOR TRANSPORTATION FACILITIES

As shown in Figure T3, the ten-year growth-related cost of planned enhancement projects is approximately \$236 million. The upper two-thirds of the table lists CIP projects, as shown in the 4/4/16 draft transportation DIF study. The bottom third of the table lists additional Action Investment Program capital improvements, with updated capital costs as provided by Boulder's transportation staff.

The ten-year, growth-related share to be funded by DET revenue is 14.2% of the local cost (i.e. total cost, less grant funding), which equates to \$30.65 million over ten years. Based on the CIP analysis by staff, approximately 89% of the growth cost is for Bus Bike Walk improvements (i.e. \$30.08 million over ten years.) and 11% will be spent on vehicular capacity (i.e. \$3.57 million over ten years).

Figure T3: Growth-Related Cost of Transportation Enhancements

CIP#	Project Location	Description	Ten-Year Cost (less grants)	Enhancement Cost Due To Growth		Growth Share of Local Cost
				FY16-25 Bus Bike Walk	FY16-25 Streets	
310TR052OG	Citywide Funds 2800 & 2	TIP local match & TMP impleme	\$18,363,000	\$1,642,800	\$182,500	9.9%
310TR003OC	Citywide	Major capital reconstruction an	\$4,800,000	\$436,900	\$39,700	9.9%
310TR773OC	Citywide	Pedestrian facilities repair/repl	\$3,774,000	\$375,500	\$0	9.9%
310TR153NG	* 30th St & Colorado	Local share of bike/ped underp	\$3,150,000	\$588,500	\$149,600	23.4%
310TR156NC	Boulder Creek & Arapa	Reconstruction and multimodal	\$2,500,000	\$248,300	\$0	9.9%
3102ABCK03	Boulder Creek - Arapaho	Underpass	\$2,365,000	\$234,100	\$0	9.9%
310TR152NG	* Broadway - Violet to H	Local share of reconstruction &	\$1,825,000	\$661,000	\$34,800	38.1%
310TR692OC	Citywide	Bikeway facilities enhancement	\$1,350,000	\$133,700	\$0	9.9%
3102ABCK01	Boulder Creek	Path lighting	\$979,680	\$97,000	\$0	9.9%
310TR743NC	28th St - Valmont to Iris	Multimodal improvements	\$860,000	\$76,900	\$8,500	9.9%
3102ABCK02	Boulder Creek	Path improvements	\$770,000	\$76,200	\$0	9.9%
310TR112OC	Citywide	Pedestrian facilities enhanceme	\$750,000	\$74,300	\$0	9.9%
310TR692OC	Citywide	Tributary greenways	\$585,000	\$57,900	\$0	9.9%
310BJ002NC	Bluff & 30th St	Traffic signal	\$532,000	\$10,500	\$42,100	9.9%
310TD019NC	28th St - Baseline to Iris	Complete street elements; turn	\$470,000	\$42,000	\$4,700	9.9%
310TDOO4OC	Citywide Funds 2810 & 3	Development coordination	\$450,000	\$337,500	\$112,500	100.0%
310TR157NG	Citywide	Bldr Co/City Joint TIP Scoping &	\$289,000	\$289,000	\$0	100.0%
310TD021OC	Citywide	Intersection improvements	\$200,000	\$4,000	\$15,800	9.9%
310TR479OC	30th & Colorado	Transportation Corridor Study	\$200,000	\$150,000	\$50,000	100.0%
310TR154NG	* 19th - Norwood to Up	Local share of reconstruction &	\$157,000	\$16,800	\$8,400	16.1%
310TR480NC	East Arapahoe	Transportation Corridor Study	\$100,000	\$75,000	\$25,000	100.0%
310TR151NG	* Boulder Slough - 30th	Local share of multiuse path (to	\$96,000	\$47,500	\$0	49.5%
Years 7-10	Citywide	Additional improvements	\$29,710,500	\$3,783,600	\$449,100	14.2%
Action Plan Capital Improvements			Action Plan Ten-Year Cost			
		Transit Capital Plan	\$38,900,000			
		New and Modified Community Transit Network Routes	\$26,165,000			
		Community Transit Network Routes Converted to BRT	\$12,833,000			
		Quiet Zones Improvements	\$5,000,000			
		HOP Conversion to Clean Vehicles	\$12,000,000			
		East Circulator / Williams Village Improvements	\$16,301,000			
		Other Non-Transit Enhancements	\$50,757,000			
* Projects with grant funding;			Ten-Year Total =>	\$236,232,180	\$30,083,900	\$3,570,700
enhancement cost growth share is approximately 5.9% of total cost					89%	11%
				\$33,654,600	<= Ten Year Total to be funded by DET	
				\$202,577,580	<= Total to be funded by other revenues	

COST ALLOCATION FOR BUS BIKE WALK FACILITIES

The demand for walk/bike/transit facilities is a function of both residential and nonresidential development. As shown in Figure T4, functional population is similar to what the U.S. Census Bureau calls "daytime population" by accounting for people living and working in a jurisdiction. In addition to the Boulder-specific data, TischlerBise has relied on extensive public and private sector input to establish reasonable "weighting factors" to account for time spent at either residential or nonresidential development. These weighting factors are shown below with grey shading.

The functional population analysis starts with 2015 estimates of jobs and population in Boulder (see yellow highlighting), as documented in the Land Use Assumptions by TischlerBise. According to the

2013 TMP State of the System report (see page 3-13), approximately 10% of Boulder jobs are self-employed persons. The remaining 90% of jobs require “journey-to-work” travel. The 2014 Boulder Valley Employee Survey indicates Boulder residents held 38% of these jobs, with persons living outside of Boulder holding the remaining 62% of journey-to-work jobs. The functional population analysis assumes all workers spend ten hours per weekday (annualized average) at nonresidential locations.

Residents who work in Boulder are assigned 10 hours to nonresidential development (discussed above) and 14 hours to residential development. Residents who work outside Boulder are assigned 14 hours to residential development. Jobs held by non-residents are assigned 10 hours to nonresidential development. Residents who don't work are assigned 20 hours per day to residential development and four hours per day to nonresidential development (annualized averages) to account for time spent shopping, eating out, and other social/recreational activities.

Based on Boulder’s 2015 functional population analysis, the cost allocation for residential development is 60%, while nonresidential development accounts for 40% of the demand for Bus Bike Walk infrastructure.

Figure T4: Functional Population

Boulder Functional Population Analysis						
Service Units in 2015						
					Demand Hours/Day	Person Hours
Nonresidential						
	Jobs Located in City*	98,510				
	10% Self-employed	9,851			10	98,510
	Jobs Requiring Journey-To-Work	88,659				
	Jobs Held By Residents**	38%	33,690		10	336,900
	Jobs Held By Non-residents**	62%	54,969	<= 56% of jobs	10	549,690
	Non-working Residents	51,054			4	204,216
						Nonresidential Subtotal
						1,189,316
						Nonresidential Share =>
						40%
Residential						
	Population*	104,808				
	Non-working Residents	51,054			20	1,021,080
	Resident Workers	53,754				
	81% Residents Working in City (includes self-employed)***		43,541	<= 44% of jobs	14	609,574
	19% Residents Working Outside City***	10,213			14	142,982
						Residential Subtotal
						1,773,636
						Residential Share =>
						60%
					TOTAL	2,962,952
* Boulder Land Use Assumptions, TischlerBise 01/27/16.						
** Percentages from 2014 Boulder Valley Employee Survey, Table 36, Question 32.						
*** Percentages from 2014 Boulder Community Household Survey, Table 112, Question 24.						

Based on the cost of planned transportation enhancements (see Figure T3 above) Bus Bike Walk improvements account for approximately \$30.08 million over the next ten years. As shown in Figure T4, 60% of this amount, divided by the projected increase in Boulder's population over the next ten years, yields a capital cost of \$2,381 per additional resident. The Bus Bike Walk component of the 2016 DET for transportation improvements is equal to the cost per person multiplied by the average number of persons per dwelling, by size range (i.e. square feet of finished living space). For example, an apartment building with small units (800 or less square feet) would have to pay \$2,381 per person multiplied by an average of 1.17 persons per dwelling, or 2,786 per dwelling unit (rounded). The DET for nonresidential development is equal to the capital cost per additional job, multiplied by the average number of jobs per development unit, for each type of development.

Figure T5: Bus Bike Walk Improvements Allocated to Population & Jobs

Ten Year Growth Cost of Bus Bike Walk Improvements =>			\$30,083,900
Cost Range and Allocation per Service Unit			
	<i>Proportionate Share Based on Functional Population</i>	<i>2015 to 2025 Increase</i>	<i>Cost per Additional Service Unit</i>
Boulder Population	60%	7,580	\$2,381
Boulder Jobs	40%	7,013	\$1,716
2015		2025	
Population	104,808	112,388	
Jobs	98,510	105,523	
Ten Year Increase in Population plus Jobs		7.2%	
Residential			
<i>Square Feet of Living Space</i>	<i>Development Unit</i>	<i>Persons per Housing Unit</i>	<i>Preliminary Bus Bike Walk Component</i>
800 or less	Dwelling Unit	1.17	\$2,786
801 to 1200	Dwelling Unit	1.80	\$4,286
1201 to 1600	Dwelling Unit	2.19	\$5,214
1601 to 2200	Dwelling Unit	2.52	\$6,000
2201 or more	Dwelling Unit	2.83	\$6,738
Nonresidential			
<i>Type</i>	<i>Development Unit</i>	<i>Jobs per Development Unit</i>	<i>Preliminary Bus Bike Walk Component</i>
Retail / Restaurant	Sq Ft of Floor Area	0.00251	\$4.31
Office	Sq Ft of Floor Area	0.00359	\$6.16
Light Industrial	Sq Ft of Floor Area	0.00231	\$3.96
Warehousing	Sq Ft of Floor Area	0.00092	\$1.58
Institutional	Sq Ft of Floor Area	0.00081	\$1.39
Hospital	Sq Ft of Floor Area	0.00294	\$5.05
Nursing Home / Assisted Living	Bed	0.84	\$1,441
Lodging	Room	0.57	\$978

VEHICLE MILES OF TRAVEL

Figure T3 above indicates street improvements to provide additional vehicular capacity account for 11% of the growth cost, or \$3.57 million over the next ten years. The streets component of the Transportation DET is derived from custom trip generation rates (see Appendix A), trip rate adjustment factors, and the capital cost per Vehicle Mile of Travel (VMT). The latter is a function of average trip length, trip-length weighting factor by type of development, and the growth cost of transportation improvements. Each component is described below.

VMT is a measurement unit equal to one vehicle traveling one mile. In the aggregate, VMT is the product of vehicle trips multiplied by the average trip length¹. The average trip length of 3.8 miles within Boulder is from the 2012 Modal Shift Report, as derived from a survey of residents (i.e. household travel diaries).

Vehicular Trip Generation Rates

Boulder's 2016 Transportation DIF study is based on Average Weekday Vehicle Trip Ends (AWVTE). For residential development, trip rates are customized using demographic data for Boulder, as documented in Appendix A. For nonresidential development, trip generation rates are from the reference book Trip Generation published by the Institute of Transportation Engineers (ITE 9th Edition 2012). A vehicle trip end represents a vehicle either entering or exiting a development (as if a traffic counter were placed across a driveway). To calculate transportation development fees, trip generation rates require an adjustment factor to avoid double counting each trip at both the origin and destination points. Therefore, the basic trip adjustment factor is 50%. As discussed further below, the DIF methodology includes additional adjustments to make the fees proportionate to the infrastructure demand for particular types of development.

Adjustments for Commuting Patterns and Pass-By Trips

Residential development has a slightly larger trip adjustment factor of 52% to account for commuters leaving Boulder for work. According to the Boulder Valley 2012 Modal Shift report (see Figure 46), work or work commute trips by single and multiple occupancy vehicles accounted for 15.9% of production trips (i.e., all out-bound trips, which are 50% of all trip ends). Also, Table 112 (Question 24) in the 2014 Boulder Community Survey indicates that 19% of resident workers traveled outside Boulder for work. In combination, these factors ($0.159 \times 0.50 \times 0.19 = 0.02$) support the additional 2% allocation of trips to residential development.

For commercial development, the trip adjustment factor is less than 50% because retail development and some services, like schools and daycare facilities, attract vehicles as they pass by on arterial and collector streets. For example, when someone stops at a convenience store on the way home from

¹ Typical VMT calculations for development-specific traffic studies, along with most transportation models of an entire urban area, are derived from traffic counts on particular road segments multiplied by the length of that road segment. For the purpose of the DET study, VMT calculations are based on attraction (inbound) trips to development located in the service area, with trip length limited to the road network considered to be system improvements (arterials and collectors). This refinement eliminates pass-through or external- external trips, and travel on roads that are not system improvements (e.g. state highways).

work, the convenience store is not the primary destination. For the average shopping center, ITE indicates that 34% of the vehicles that enter are passing by on their way to some other primary destination. The remaining 66% of attraction trips have the commercial site as their primary destination. Because attraction trips are half of all trips, the trip adjustment factor is 66% multiplied by 50%, or approximately 33% of the trip ends.

Trip Length Weighting Factor by Type of Land Use

The transportation DET methodology includes a percentage adjustment, or weighting factor, to account for trip length variation by type of land use. As shown in Figure T6, trips associated with residential development are approximately 113% of the average trip length. The residential trip length adjustment factor includes data on work commute, driving passengers, social/recreational purposes and other work/business travel. Conversely, shopping and eating-out trips associated with commercial development are roughly 68% of the average trip length while other nonresidential development typically accounts for trips that are 72% of the average for all trips.

Figure T6: Average Trip Length by Trip Purpose in Boulder

Type of Development	Trip Purpose	Miles Percent	Miles	Trips Percent	Trips	Miles Per Trip	Weighting Factor
1-Residential	Work Commute	14.9%	2,719	9.2%	444	6.1	1.13
1-Residential	Drive a Passenger	6.6%	1,205	4.8%	232	5.2	
1-Residential	Change Mode & Other	2.9%	529	2.5%	121	4.4	
1-Residential	Social/Recreational	15.0%	2,738	13.4%	647	4.2	
1-Residential	Go Home	35.4%	6,461	34.7%	1,676	3.9	
1-Residential	Other Work/Business	3.7%	675	4.6%	222	3.0	
1-Residential Total			14,327		3,342	4.3	
2-Retail/Restaurant	Shopping	8.4%	1,533	11.1%	536	2.9	0.68
2-Retail/Restaurant	Eat a Meal	4.0%	730	7.1%	343	2.1	
2-Retail/Restaurant Total			2,263		879	2.6	
3-Other Nonresidential	Personal Business	5.7%	1,040	6.3%	304	3.4	0.72
3-Other Nonresidential	School	3.4%	621	6.3%	304	2.0	
3-Other Nonresidential Total			1,661		609	2.7	
TOTAL			18,251		4,830	3.8	

Data Source: Figures 44 and 45, Modal Shift in Boulder Valley, 2012.

DEVELOPMENT PROTOTYPES AND PROJECTED VMT

The relationship between the amount of development within Boulder and Vehicle Miles of Travel (VMT) is documented in Figure T7. At the top are data on existing and projected development units. The lower portion of the table indicates the cost allocation for street improvements. VMT per development unit is equal to AWWTE x Trip Adjustment Factor x Mode Share for Single and Multiple Occupancy Vehicles (SOV & MOV) x Trip Length Weighting Factor x Average Trip Length. Based on projected development in Boulder over the next ten years, residential development should pay for approximately 44% of the growth cost of street improvements, with the remaining 56% funded by nonresidential development.

Figure T7: Projected VMT Increase to Development within Boulder

Development Type (1)	2015 Development Units (1)	2025 Development Units (1)	Additional Development Units
Single Unit Dwellings	24,242	24,806	564
Multiple Unit Dwellings	21,498	23,752	2,254
Industrial Sq Ft	13,576,996	14,547,603	970,607
Retail Sq Ft	8,565,611	9,174,939	609,328
Office & Other Services Sq Ft	14,848,416	15,904,789	1,056,373
Housing Unit Total	45,740	48,558	2,818
Nonres KSF Total	36,991,023	39,627,331	2,636,308

(1) Land Use Assumptions, TischlerBise 2016.
(2) Residential trip rates adjusted to Boulder demographics; nonresidential trip rates are national averages (ITE 2012).
(3) Residential includes commuting pattern adjustment; Retail includes pass-by adjustment.
(4) Residential mode share from Figure 1, 2012 Modal Shift; nonresidential mode share from Table 2 (primary mode) 2014 Employee Survey.
(5) Derived from Figures 44+45, Modal Shift, 2012..
(6) Figure 19, 2012 Modal Shift

Development Type	Avg Wkdy Veh Trip Ends per Dev Unit (2)	Trip Adjustment Factors (3)	SOV+MOV Mode Share (4)	Trip Length Weighting Factor (5)	Vehicle Miles of Travel per Dev Unit	Ten Year VMT Increase	Proportionate Share by Type of Dev
Single Unit Dwellings	8.17	52%	55.5%	113%	10.12	5,710	10.27%
Multiple Unit Dwellings	6.63	52%	55.5%	113%	8.22	18,519	33.31%
Industrial (per KSF)	3.56	50%	73.2%	72%	3.56	3,460	6.22%
Retail (per KSF)	42.70	33%	73.2%	68%	26.65	16,240	29.21%
Office & Other Services (per KSF)	11.03	50%	73.2%	72%	11.05	11,668	20.99%

Average Trip Length in miles (6) =>	3.80	55,598	100.00%
Ten Year Growth Cost of DET Street Improvements =>	\$3,570,700		
DET Cost per Additional VMT =>	\$64.22		

COST ALLOCATION FOR STREET IMPROVEMENTS

Input variables for the streets portion of Boulder's 2016 Transportation DET schedule are shown in Figure T8. Inbound VMT by type of development, multiplied by the capacity cost per VMT, yields the DET amount. For example, Lodging generates 8.18 VMT per room, multiplied by the capital cost of \$64.22 per VMT, yields a DET charge of \$525 per room (rounded) for street improvements.

The text below from Trip Generation (ITE 2012) supports the consultant's recommendation to use ITE 820 Shopping Center as a reasonable proxy for all commercial development (i.e. retail and restaurants). The shopping center trip generation rates are based on 302 studies with an r-squared value of 0.79. The latter is a goodness-of-fit indicator with values ranging from 0 to 1. Higher values indicate the independent variable (floor area) provides a better prediction of the dependent variable (average

weekday vehicle trip ends). If the r-squared value is less than 0.50, ITE does not publish the value because factors other than floor area provide a better prediction of trip rates.

“A shopping center is an integrated group of commercial establishments. Shopping centers, including neighborhood, community, regional, and super regional centers, were surveyed for this land use. Some of these centers contained non-merchandising facilities, such as office buildings, movie theaters, restaurants, post offices, banks, and health clubs. Many shopping centers, in addition to the integrated unit of shops in one building or enclosed around a mall, include out parcels (peripheral buildings or pads located on the perimeter of the center adjacent to the streets and major access points). These buildings are typically drive-in banks, retail stores, restaurants, or small offices. Although the data herein do not indicate which of the centers studied include peripheral buildings, it can be assumed that some of the data show their effect.”

Figure T8: Cost of Street Improvements Allocated by VMT

Residential DET for Streets

Square Feet of Living Space	Development Unit	AWVTE per Dev Unit (2)	Trip Adjustment Factors (3)	SOV+MOV Mode Share (4)	Trip Length Weighting Factor (5)	VMT per Dev Unit	Preliminary Streets DET Component
800 or less	Dwelling Unit	3.94	51%	55.5%	113%	4.79	\$308
801 to 1200	Dwelling Unit	6.23	51%	55.5%	113%	7.57	\$486
1201 to 1600	Dwelling Unit	7.65	51%	55.5%	113%	9.30	\$597
1601 to 2200	Dwelling Unit	8.85	51%	55.5%	113%	10.76	\$691
2201 or more	Dwelling Unit	9.99	51%	55.5%	113%	12.14	\$780

Nonresidential DET for Streets

Type	Development Unit	AWVTE per Development Unit (2)	Trip Adjustment Factors (3)	SOV+MOV Mode Share (4)	Trip Length Weighting Factor (5)	VMT per Dev Unit	Preliminary Streets DET Component
Retail / Restaurant	Sq Ft	0.04270	33%	73.2%	68%	0.02665	\$1.71
Office	Sq Ft	0.01103	50%	73.2%	72%	0.01105	\$0.71
Light Industrial	Sq Ft	0.00697	50%	73.2%	72%	0.00698	\$0.45
Warehousing	Sq Ft	0.00356	50%	73.2%	72%	0.00356	\$0.23
Institutional	Sq Ft	0.01403	33%	73.2%	72%	0.00927	\$0.60
Hospital	Sq Ft	0.01322	50%	73.2%	72%	0.01324	\$0.85
Nursing Home / Assisted Living	Bed	2.74	50%	73.2%	72%	2.74	\$176
Lodging	Room	8.17	50%	73.2%	72%	8.18	\$525

FUNDING STRATEGY FOR TRANSPORTATION IMPROVEMENTS

The revenue projection shown in Figure T9 assumes implementation of the preliminary 2016 Transportation DET schedule and the development projections described in the Land Use Assumptions by TischlerBise. To the extent the rate of development either accelerates or slows down, there will be a corresponding change in DET revenue and the timing of capital improvements.

Preliminary DET rates are expected to yield almost \$32 million over the next ten years, which will cover the growth share of planned transportation improvements (i.e. CIP plus Action Investment Program). In comparison, the current Transportation DET rate schedule would yield approximately \$11.5 million over the next ten years. Based on the proposed 2016 methodology, residential development will pay approximately 52% of growth-related cost for transportation system improvement, with nonresidential development covering the remaining 48%.

Figure T9: Projected Transportation DET Revenue

		<i>Residential</i>	<i>Light Industrial</i>	<i>Retail</i>	<i>Office & Other Services</i>
Preliminary DET Rates =>		\$5,811	\$4.41	\$6.02	\$6.87
Year		per housing unit	per 1000 Sq Ft	per 1000 Sq Ft	per 1000 Sq Ft
		<i>Housing Units</i>	<i>Square Feet</i>	<i>Square Feet</i>	<i>Square Feet</i>
Base	2015	45,740	13,576,996	8,565,611	14,848,416
Year 1	2016	46,012	13,670,663	8,624,414	14,950,360
Year 2	2017	46,288	13,765,405	8,683,890	15,053,473
Year 3	2018	46,566	13,860,809	8,743,783	15,157,308
Year 4	2019	46,846	13,956,881	8,804,095	15,261,869
Year 5	2020	47,127	14,053,626	8,864,830	15,367,162
Year 6	2021	47,409	14,151,048	8,925,989	15,473,193
Year 7	2022	47,694	14,249,152	8,987,577	15,579,965
Year 8	2023	47,980	14,347,942	9,049,596	15,687,486
Year 9	2024	48,268	14,447,424	9,112,049	15,795,758
Year 10	2025	48,557	14,547,603	9,174,939	15,904,789
Ten Year Increase		2,817	970,607	609,328	1,056,373
Projected Revenue =>		\$16,372,000	\$4,280,000	\$3,668,000	\$7,257,000
Total Projected Transportation DIF Revenue (rounded) =>					\$31,577,000
Res Share =>		52%	Nonres Share =>		
			48%		

APPENDIX A: LAND USE ASSUMPTIONS RELATED TO TRANSPORTATION

Most of the demographic data for Boulder's 2016 transportation studies may be found in memo dated January 27, 2016 regarding "Draft 3 Land Use Assumptions for Impact Fee/Excise Tax Studies." This Appendix contains additional information specific to the transportation analysis, such as customized vehicle trip generation rates for the City of Boulder.

CUSTOM TRIP GENERATION RATES BY DWELLING SIZE

As an alternative to simply using national average trip generation rates for residential development, as published by the Institute of Transportation Engineers (ITE), TischlerBise derived custom trip rates using local demographic data. Key inputs needed for the analysis (i.e. average number of persons and vehicles available per housing units) are available from American Community Survey (ACS) data for Colorado Public Use Microdata Area 803, which is essentially the City of Boulder.

City of Boulder Control Totals

The 2010 census did not obtain detailed information using a "long-form" questionnaire. Instead, the U.S. Census Bureau has switched to a continuous monthly mailing of surveys, known as the American Community Survey (ACS), which is limited by sample-size constraints. For example, data on detached housing units are now combined with attached single units (commonly known as townhouses). Part of the rationale for deriving development related transportation taxes/fees by bedroom range, as discussed further below, is to address this ACS data limitation. Because townhouses generally have fewer bedrooms and less living space than detached units, fees by dwelling size ensure proportionality and facilitate construction of affordable units.

According to the U.S. Census Bureau, a household is a housing unit that is occupied by year-round residents. Development fees often use per capita standards and persons per housing unit, or persons per household, to derive proportionate-share fee amounts. TischlerBise recommends that fees for residential development in Boulder be imposed according to the number of year-round residents per housing unit. Figure A1 indicates the average number of year-round residents per housing unit in Boulder. In 2013, the control total for the City of Boulder is 2.14 persons per dwelling (i.e. weighted average for all types of housing).

Figure A1: Year-Round Persons per Unit by Type of Housing

2013 Summary by Two House Types

Units in Structure	Persons	Households	Persons per Household	Housing Units	Persons per Housing Unit	Housing Mix	Vacancy Rate
Single Unit*	57,742	22,479	2.57	23,284	2.48	53%	3%
All Other	36,747	19,828	1.85	20,767	1.77	47%	5%
Subtotal	94,489	42,307	2.23	44,051	2.14		4%
Group Quarters	8,674						
TOTAL	103,163						

* Single unit includes detached and attached (e.g. townhouse).

Source: Tables B25024, B25032, B25033, and B26001.

2013 American Community Survey 1-Year Estimates, U.S. Census Bureau.

Trip generation rates are also dependent upon the average number of vehicles available per dwelling. Figure A2 indicates vehicles available per housing unit in the City of Boulder. For the purpose of customizing vehicle trip generation rates, the control total for Boulder is an average of 1.55 vehicles available per housing unit.

Figure A2: Vehicles Available per Housing Unit

Tenure	Vehicles Available (1)	Households (2)		
		Single Unit Detached or Attached	All Other	Total
Owner-occupied	35,644	16,469	3,657	20,126
Renter-occupied	32,522	6,010	16,171	22,181
Total	68,166	22,479	19,828	42,307

Units per Structure	Vehicles Available	Housing Units (3)	Vehicles per Housing Unit
Single Detached or Attached	37,979	23,284	1.63
All Other	30,187	20,767	1.45
Total	68,166	44,051	1.55

(1) Vehicles available by tenure from Table B25046, American Community Survey, 2013.

(2) Households by tenure and units in structure from Table B25032, ACS, 2013.

(3) Housing units from Table B25024, American Community Survey, 2013.

Customized Trip Rates by Dwelling Size and Type

Custom tabulations of demographic data by bedroom range can be created from individual survey responses provided by the U.S. Census Bureau, in files known as Public Use Micro-data Samples (PUMS). Because PUMS files are available for areas of roughly 100,000 persons, the City of Boulder approximates Colorado Public Use Micro-data Area (PUMA) 803. At the top of Figure A3, in the cells with yellow shading, are the 2013 survey results for Boulder (latest available). Unadjusted survey results derived from PUMS data (i.e. persons per dwelling and vehicles available per dwelling), were adjusted to match control totals for the City of Boulder, as documented above in Figures A1 and A2.

The middle section of Figure A3 provides nation-wide data from the Institute of Transportation Engineers (ITE). AWWTE is the acronym for Average Weekday Vehicle Trip Ends, which measures vehicles coming and going from a development. Dividing trip ends per household by trip ends per person yields an average of 2.01 persons per occupied apartment and 3.73 persons per occupied single dwelling, based on ITE's national survey. Applying Boulder's current housing mix of 47% apartments and 53% single-unit dwellings yields a weighted average of 2.92 persons per household. In comparison to the national data, Boulder only has an average of 2.14 persons per housing unit.

Dividing trip ends per household by trip ends per vehicle available yields an average of 1.30 vehicles available per occupied apartment and 1.58 vehicles available per occupied single dwelling, based on ITE's national survey. Applying Boulder's current housing mix of 47% apartments and 53% single-unit dwellings yields a weighted average of 1.45 vehicles available per household. In comparison to the national data, Boulder has more vehicles available, with an average of 1.55 per housing unit.

Rather than rely on one methodology, the recommended trip generation rates shown in the bottom section of Figure A3 (see Boulder AWWTE per Housing Unit in bold numbers), are an average of trip rates based on persons and vehicles available, for all types of housing units by bedroom range. In the City of Boulder, each housing unit is expected to yield an average of 7.45 Average Weekday Vehicle Trip Ends (AWVTE), compared to the national average of 8.17 trip ends per household.

Figure A3: Persons and AWWTE by Bedroom Range and House Type

City of Boulder 2013 Data								
Bedroom Range	Persons (1)	Vehicles Available (1)	Housing Units (1)	Boulder Hsg Mix	Unadjusted Persons/HU	Adjusted Persons/HU (2)	Unadjusted VehAvl/HU	Adjusted VehAvl/HU (2)
0-1	114	89	89	19%	1.28	1.31	1.00	0.95
2	220	162	121	25%	1.82	1.86	1.34	1.27
3	296	236	134	28%	2.21	2.26	1.76	1.66
4+	372	300	135	28%	2.76	2.83	2.22	2.10
Total	1,002	787	479		2.09	2.14	1.64	1.55
National Averages According to ITE								
ITE Code	AWVTE per Person	AWVTE per Vehicle Available	AWVTE per Household	Boulder Hsg Mix		Persons per Household		Veh Avl per Household
220 Apt	3.31	5.10	6.65	47%		2.01		1.30
210 SFD	2.55	6.02	9.52	53%		3.73		1.58
Wgtd Avg	2.91	5.59	8.17			2.92		1.45
Recommended AWWTE per Dwelling Unit by Bedroom Range								
Bedroom Range	AWVTE per Housing Unit Based on Persons (3)	AWVTE per Housing Unit Based on Vehicles Available (4)	Boulder AWWTE per Housing Unit (5)	<div>(1) American Community Survey, Public Use Microdata Sample for CO PUMA 803 (2013 One-Year unweighted data). (2) Adjusted multipliers are scaled to make the average PUMS values match control totals based on American Community Survey 2013 1-year data for the City of Boulder. (3) Adjusted persons per housing unit multiplied by national weighted average trip rate per person. (4) Adjusted vehicles available per housing unit multiplied by national weighted average trip rate per vehicle available. (5) Average of trip rates based on persons and vehicles available per housing unit.</div>				
0-1	3.81	5.31	4.56					
2	5.41	7.10	6.26					
3	6.58	9.28	7.93					
4+	8.24	11.74	9.99					
Total	6.23	8.66	7.45					
AWVTE per Dwelling by House Type								
ITE Code	AWVTE per Housing Unit Based on Persons (3)	AWVTE per Housing Unit Based on Vehicles Available (4)	Boulder AWWTE per Housing Unit (5)		Boulder Persons/HU		Boulder VehAvl/HU	
All Other	5.15	8.11	6.63		1.77		1.45	
210 SFD	7.22	9.11	8.17		2.48		1.63	
All Types	6.23	8.66	7.45		2.14		1.55	

Trip Generation by Dwelling Size

To derive AWWTE by dwelling size, TischlerBise matched trip generation rates and average floor area, by bedroom range, as shown in Figure A4. The logarithmic trend line formula, derived from the four actual averages in Boulder, is used to derive estimated trip ends by dwelling size, across five size thresholds. TischlerBise does not recommend average fees for all house sizes because it makes small units less affordable and essentially subsidizes larger units.

Apartment units will generally be in the three smallest size thresholds, with one-bedroom units being 800 square feet or less, two-bedroom units ranging from 801 to 1200 square feet, and a few three-bedroom apartments being at least 1201 square feet.

Single-unit dwellings (both detached and attached) will have floor areas that correspond to the three largest size thresholds. Smaller units will likely have 1201 to 1600 square feet of living space. The most common single-unit dwelling will have three bedrooms and likely range from 1601 to 2200 square feet. All units with 2201 or more square feet of living space are assumed to generate a maximum 9.99 AWWTE per dwelling.

Figure A4: Vehicle Trips by Dwelling Size

Actual Averages per Hsg Unit			Fitted-Curve Values	
Bedrooms	Square Feet	Trip Ends	Sq Ft Range	Trip Ends
0-1	700	4.56	800 or less	3.94
2	1,100	6.26	801 to 1200	6.23
3	1,800	7.93	1201 to 1600	7.65
4+	2,900	9.99	1601 to 2200	8.85
			2201 or more	9.99

Average dwelling size by bedroom range is from Property Assessor parcel database. Average weekday vehicle trip ends are calibrated to 2013 1-Year ACS PUMS data for CO PUMA 803 (City of Boulder).

